civity Management Consultants

Machine Learning for Transport Modelling

the Next Generation of Transport Models

8th GeoIT Wherecamp Conference 2018

Berlin, 24th October 2018 | Andreas Wolf & Benno Bock

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We offer solutions for communal companies: from the automotive sector to waste management

Industries & customers

Rail

- DSB
- ÖBB
- SNCF
- SBB CFF FFS
- DB

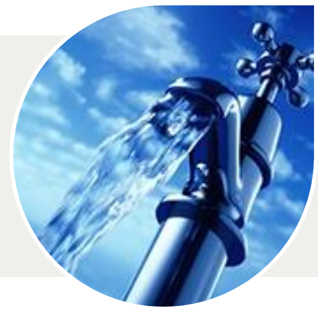
Public Transport

- HOCHBAHN
- movia
- ZVV EIN TICKET FÜR ALLES
- Ruter#
- WIENER LINIEN

Mobility

- MOIA
- VOLKSWAGEN GROUP
- M Flughafen München
- DAIMLER
- Gett

Supply



- bdew Energie. Wasser. Leben.
- Berliner Wasserbetriebe
- GELSENWASSER GAS. STROM. NATÜRLICH WASSER.
- RheinEnergie

Waste Management

- AWB
- AWM
- BERLIN RECYCLING
- BSR

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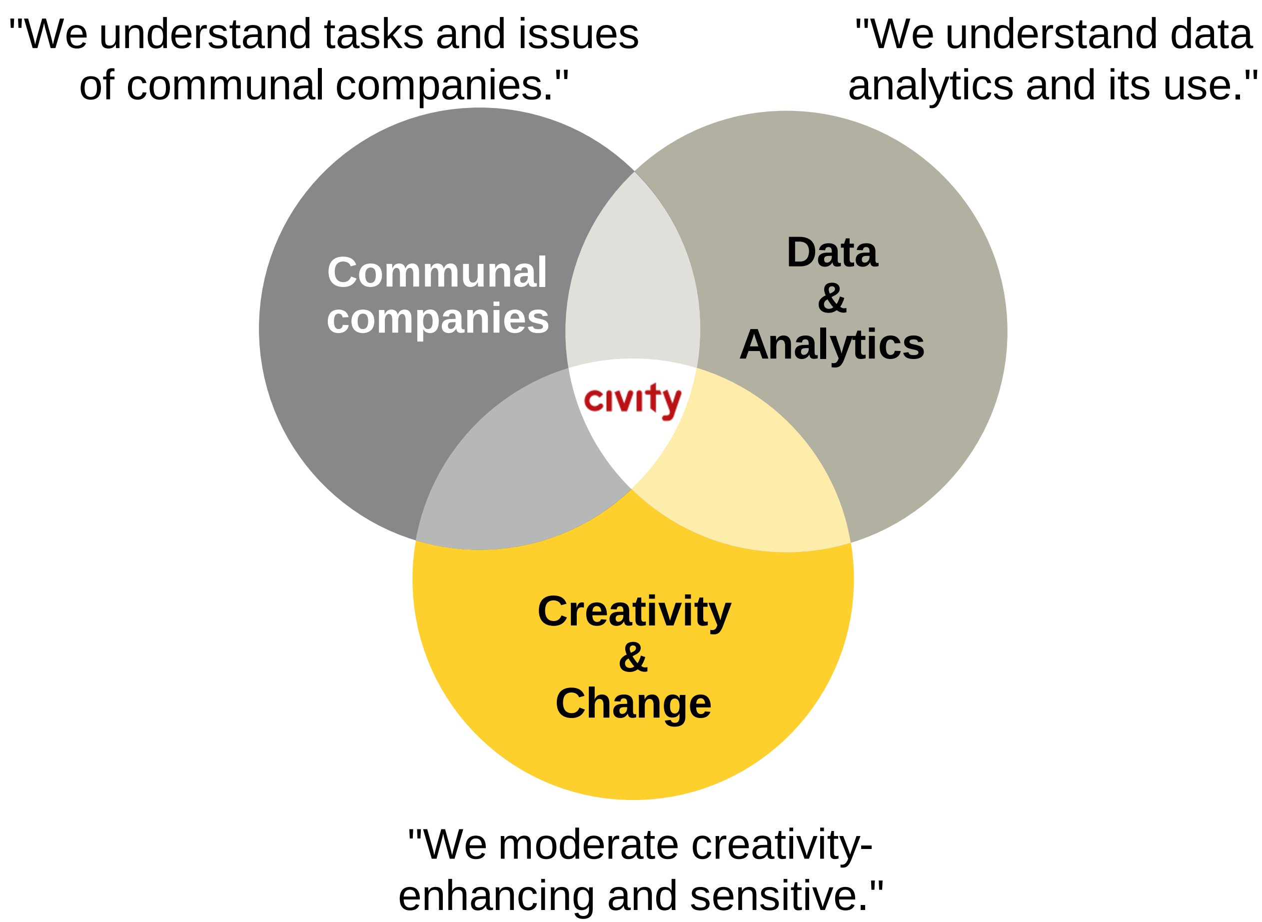
The strength of civity lies in the interaction of technical expertise and methodological competence.

Interaction of technical expertise and methodological competence

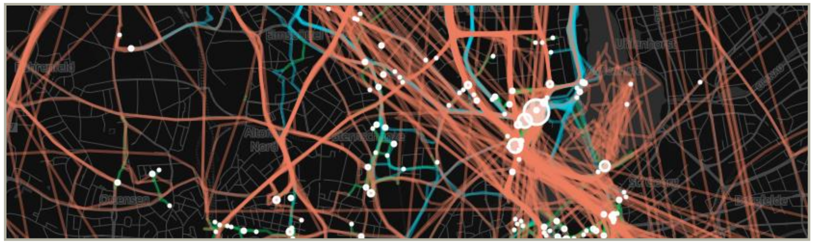


Technical expertise and meth-odological competence of civity

Our R&D projects depict an interesting contrast between new mobility providers and classic PT operators

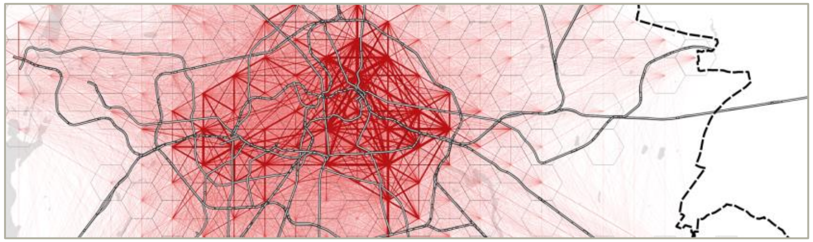
R&D projects for mobility demand forecasting

European Car-Manufacturer



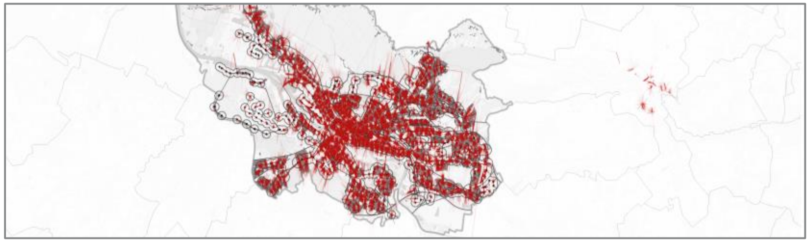
Identification and evaluation of the market potential for tier-2 cities in Europe based on mobile phone cell data. Derivation of a market entry strategy including a scalable value proposition for individual markets.

civity matters No. 1



Study on free-floating car sharing in European cities. The focus is on the evaluation of the traffic and economic relevance of the new system in comparison to public transport.

LogFile Analysis



Study for the evaluation of LogFiles generated via a PT information app. Correlation analyses with data from automated passenger counts. Conclusions on extrapolation of results.

Transport modelling is strongly influenced by innovations in methodology, computing capacity and data availability

Relevant methods for transport modelling

Transport modelling

- **Classic Four-step Model**
  - **Generation** – (inbound-/outbound-) traffic volumes in spatial subsets (traffic cells) with trip generation
  - **Distribution** – Origin-destination-relations/trips between traffic cells through destination choice models
  - **Mode choice**
  - **Route choice**
- **Activity-based Model** – Additional formation of relevant groups of people and activity chains, e.g. home – working – shopping – home
- **Multi Agent Model** – Formation of a synthetic population with daily plans formed from alternating activities and routes; creation of a utility model; iterative optimisation of the resulting individual utility in order to maintain a system equilibrium.
- **xMND Project: Data Analytics / Business Analytics** – mFUND Das Startkapital für die Mobilität 4.0 | BMVI | NEXT | Fraunhofer IAIS

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For the xMND-approach we use an machine learning approach to estimate mobility demand

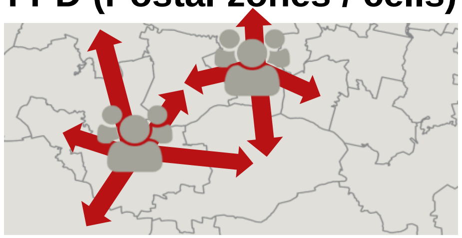
Idea and first approach

- Floating Phone Data (FDP) → Origin-Destination-Matrix on postal code level
- Fine-grained data (~10m with 26 categories)
- Europe-wide dataset (cities and functional urban citiy areas)
- Many other fine-grained spatial data available

For the xMND-approach we use an machine learning approach to estimate mobility demand

Machine learning with floating phone data (ML FPD)

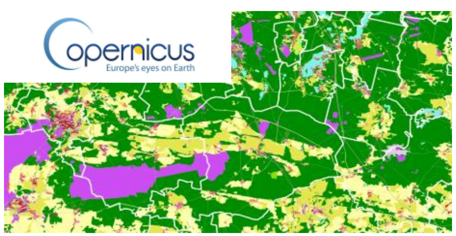
FPD (Postal zones / cells)



Other data sources

???

Urban Atlas Data



Aggregation

Merging

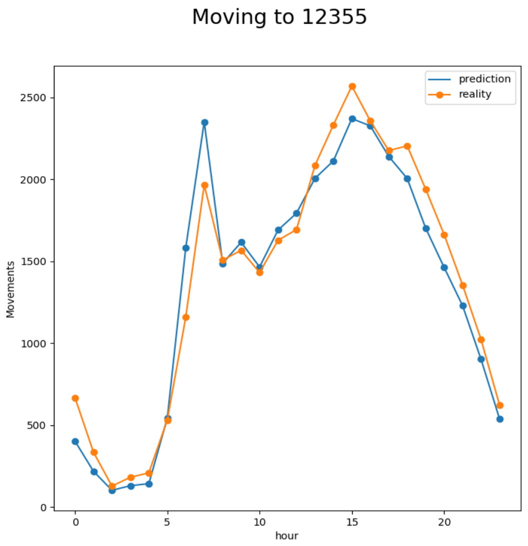
Regression models

Travel demand model

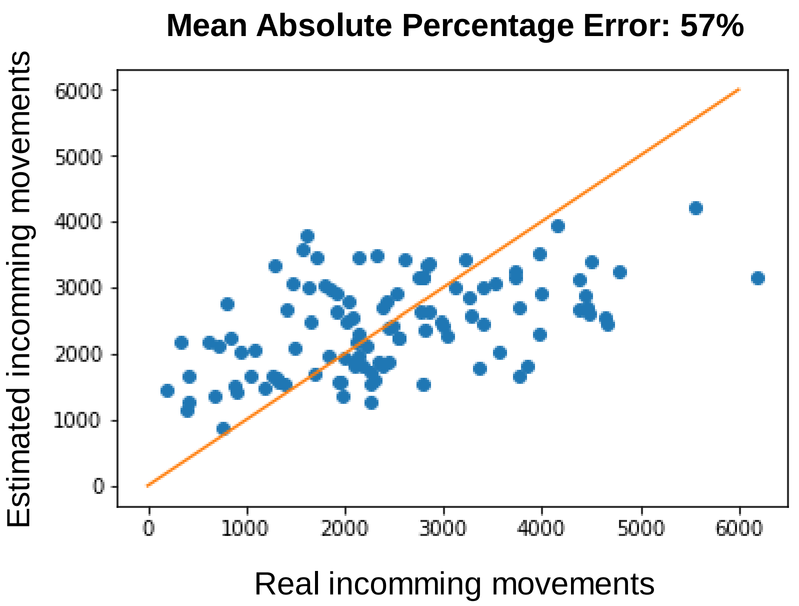
The first approach already shows mixed results

Initial results for German postal areas

Measured and modelled daily demand curves



Mean absolute errors for estimations of incoming movements, workdays 4PM



Additional spatial data and different approaches can lead to further improvements

Main challenges

Data

Population data (Zensus)	Area data (e.g. size)	Bigger trainingset with more cities

Models

OD-relations	Adjusting layers	Hyperparameter optimisation

Projection

Arbitary grid	Disaggregation of cell relations

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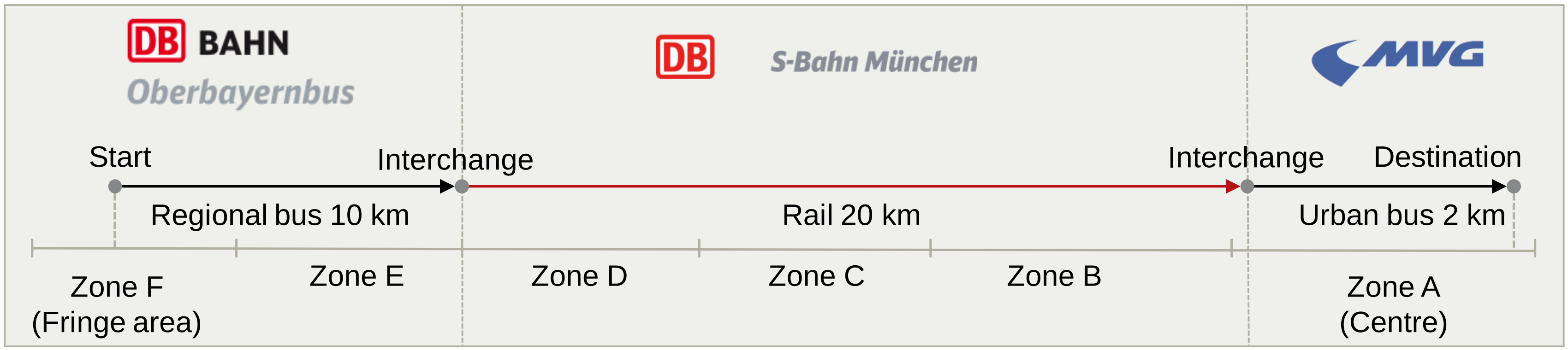
The primary use-case in the xMND context will be the revenue distribution for integrated PT services

Use-case revenue distribution for PT

EXAMPLE



Principle	Measurement	Calculation for DB SBM	Revenue
Entries	One entry each vehicle	[1 / (1 + 1 + 1)] x 10 €	**= 3.33 €**
Pkm	Kilometres travelled	[20 km / (20 km + 10 km + 2 km)] x 10 €	**= 6.25 €**
Tarif zones[1)]	Rail: 3.5 Regional bus: 2 Urban bus: 0.5	[3.5 / (3.5 + 2 + 0.5)] x 10 €	**= 5.83 €**
Entries und Pkm	15 % und 85 %	3.33 € x 15% + 6.25 € x 85%	**= 5.81 €**

Assumption: single ticket price 10 €

1) Assumption: Interchange zones count 50% for each provider

Thank you for your attention!

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